REMARKS

Claims 1-10 and 19-22 are pending in this application. Claims 1, 20 and 21 have been amended to reword claim limitations. A limitation relating to passivation material has been removed from claim 1 and now appears in dependent claim 22.

Rejections under 35 U.S.C. § 103(a)

The rejections of pending claims are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 6,258,020 to Dai et al. in view of U.S. Patent No. 6,111,280 to Gardner and/or further in view one more additional references has been maintained.

"Functional" Limitations

Applicants maintain that the claims are patentable at least because "the polymer layer.. alters the electrical properties of the at least one nanotube from p-type to n-type response to application of a gate voltage" is not taught or suggested by Dai or Gardner. Applicants have amended the claim to make clear that the limitation describes a specific material property of the polymer layer, namely that it alters the nanotube properties so that the resulting device exhibits properties of an n-type FET. This feature is not in the prior art.

In refusing to consider this limitation, the Examiner states:

> "Applicants' arguments that all functional limitations must be given patentable weight is wrong, as current caselaw (In re Swinehart, 169 USPQ 226 (CCPA) and In re Fuller (1929 C.D. 388 O.G. 299) requires that functional limitations recited only in proper format be given patentable weight." (Advisory Action, page 2)

Applicants submit that the Examiner is incorrect in the application of the cited caselaw to the claimed limitation. Rather, functional language that further limits a structure composition already defined in the claim is permissible and should be given patentable weight. See, e.g., *In re Swinehart*, 169 USPQ 226, 228 (CCPA 1971). See, also, *Sanada v. Reynolds*, 67 USPQ 2nd 1469, 1463 (Bd. Pat. App. & Interferences 2003). Indeed one of the cases cited by the Examiner, *In re Swinehart*, explicitly states that:

> "There is no support, either in the actual holdings of prior cases or in the statute, for the proposition that functional language, in and of itself, renders a claim improper. We have found no prior decision of this or any other court that may be said to hold that there is some other ground for

objecting to a claim on the basis of any language, "functional" or otherwise, beyond what is already sanctioned by the provisions of U.S.C. §112. *Id* at 229.

The facts and application of law in *In re Swinehart* are instructive. In *Swinehart*, the Court of Customs and Patent Appeals found that the functional phrase "transparent to infra-red rays" was to be given patentable weigh because it limited the claimed composition of a solidified melt of B_aF_2 and C_aF_2. *Id* at 230. Similarly, in the instant claim, the functional language "alters the electrical properties of the at least one nanotube from p-type to n-type response to application of a gate voltage" further limits the composition "polymer layer." Note that not all polymer layers alter the electrical properties of a nanotube from a p-type response to a n-type. Rather, Applicants' claims recited a class a polymers defined by the recited material property of the layer. In *Swinehart*, it was found that the functional language "transparent to infra-red rays" distinguished the claimed invention from the prior art compositions that were opaque to such rays, and so rendered the claims patentable. *Id* at 230. So, too, should the language in the instant claims be evaluated for patentability.

Moreover, each of the other limitations that the Examiner has refused to consider in light of the prior art references are either structural or functional limitations which further limit structural features. None of the recited elements are wholly functional. As such, these are positive limitations that must be considered.

With regard to the Examiner's statement that the functional limitations are not in proper form, Applicants also disagree. Applicants could find no mention in the relevant caselaw or MPEP that would suggest that the claimed form is improper. Rather, as discussed above, the language properly limits a composition. Nevertheless, to address the Examiner's concern that the claims do not recite an n-type FET and advance prosecution, Applicants have amended the claims to explicitly recite that the sensor comprises an n-type FET.

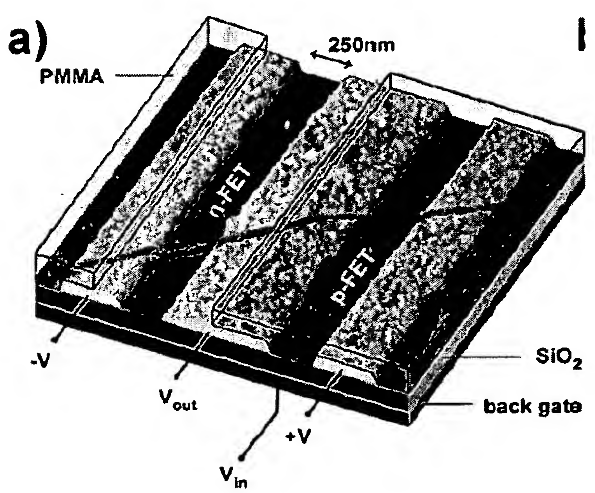
Accordingly, Applicants request that the Examiner evaluate each of these limitations in light of the cited references and point to the source of the pertinent claim features in said references.

Claim 1

Claim 1 is rejected over Dai in view of Gardner. As described in the specification, semiconducting nanotubes exhibit p-type FET characteristics. The polymer layer described by

applicants' claim 1 alters the properties so that the resulting device exhibits properties of an n-type FET. Compare FIG. 4A with FIG. 4B of Applicants' specification: FIG. 4A shows decreasing conductance of the uncoated device as the gate voltage increases (p-type FET), whereas FIG. 4B shows that the conductance of a device having a polymer layer as recited in Applicants' claims increases with the increase of gate voltage (n-type FET). This feature is not taught or suggested by Dai or Gardner.

Dai shows only PMMA deposited on the carbon nanotubes, which is used to improve sensitivity and response time to the nanotube device. Applicants are submitting (in an IDS accompanying this response) a Nano Letters article by Dercker et al., which evidences that PMMA does not alter the properties of the nanotube so that it exhibits n-type characteristics. See, Figure 3(a), reproduced below, which shows a CNT, part of which is covered by PMMA. The portion covered by PMMA remains p-type.



Therefore, Dai does not teach or suggest "an adsorbed polymer...that alters the electrical properties of the at least one nanotube from p-type to n-type response to application of a gate voltage." Rather, Dai teaches only a PMMA layer, which is shown not to alter the response of the nanotube from p-type to n-type. Gardner does remedy the deficiencies of Dai.

For at least the above reasons, Applicants submit that the claim 1 and its dependent claims are patentable over the cited art.

New claim 23

In addition to the reasons given above with respect to claim 1, Applicants submit that the dependent claim 23, which specifies that that the polymer layer is less than about 10 nm thick is independently patentable. As described in Dai, "the PMMA coating...is typically about 100 nanometers thick." Nothing in Dai or any of the other references teaches or suggests a very thin coating on the nanotubes.

Claim 9 and new claim 24

Claim 9 and new claim 24 both relate to ammonia sensing using a polyethylimine layer that interacts with the target ammonia species. In rejecting claim 9, the Examiner states that Buckley teaches the use of PEI as an ammonia sensor and so it would be obvious to one of skill to combine the Dai device to use PEI as the polymer overlayer (presumably in place of PMMA).

Applicants traverse this rejection. Buckley relates to using conductive polymer coated fabrics which together may be used to obtain a "fingerprint" of responses to the sensors. The fingerprint pattern is obtained by exposing a plurality of fabric chemical sensors (of various dopants, fiber thicknesses, fiber compositions and polymer overcoats, respectively) to the chemical vapor. Conductive polymers (not PEI) and dopants are deposited on various different fibers, and the response to a number of different combinations of dopants, fiber thicknesses, fiber compositions and polymer overcoats can be used to identify an analyte. In the description of Figure 10, Buckley describes investigating the deposition of an additional polymer on top of the conductive polymer overcoat to improve the sensitivity and/or hydrophobicity of the conductive polymer. Note that Buckley does not teach or suggest depositing PEI or other polymer directly on the fabric, but only as an additional layer on the conductive polymer. Figure 10 itself shows that PEI *decreases* the signal over the uncoated NDSA conductive polymer in response to NH_3. See Figure 10, which shows the change in resistivity using a PEI coated NDSA polymer is only 0.12%, while the uncoated NDSA polymer has a resistivity change of 4.33%.

Applicants submit that one of skill would not arrive at the claimed invention for at least the following reasons: 1) while Buckley describes coating a conductive polymer with PEI, there is no teaching or suggestion that PEI be deposited on a nanotube, 2) because the data shown in Figure 10 clearly show that PEI renders the conductive polymer *less sensitive* to NH_3, one of skill in the art would not replace the PMMA layer described in Dai with PEI.

Conclusion:

In light of the foregoing amendments and remarks, Applicants respectfully submit that all pending claims are now in condition for allowance. Thus, Applicants respectfully request a Notice of Allowance from the Examiner. Should any unresolved issues remain, the Examiner is encouraged to contact the undersigned at the telephone number provided below. However, if the Commissioner determines that any additional fee is due, such fee may be charged to deposit account No. 504480 (Order No. NANOP002).

Respectfully submitted,
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